Feasibility of site-dependent impact assessment of acidification in LCA

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Abstract

Consumers select environmental friendly products and services, possibly relying on the eco-label. Producers improve their products by ameliorating the most polluting link. Governments make decisions based on expected environmental impact of proposed product policies. To make all this possible necessitates the availability of metholds to calculate impact of products and services on the environment. One method that considers all impacts of a product 'from cradle to grave' is Life Cycle Assessment (LCA).
An LCA draws processes that together build the considered product or service, from resource extraction to waste treatment. Emissions from all these processes aggregate into an inventory table. For example SO_2 emissions of each process are determined and the inventory table lists the total amount of SO_2 emitted during the life cycle of the product. The next phase of LCA, life cycle impact assessment (LCIA), determines the environmental impact of the emissions listed in the inventory table. The nature of the present inventory table does not permit side-dependent LCIA since the emissions are listed in an aggregated way, not subdivided per country. This report considers the environmental impact acidification. SO_2, NO_x, and NH_3 are the principal contributers to this impact.

Acid rain in Sweden harms the environment more than acid rain falling on calcareous grounds in southern Europe. This indicates that environmental impact is not always the same for equal amounts of emission released at different geographical locations. Site-dependent LCIA takes into account the geographical origin of the emissions by introducing site-dependent impact factors. For example, emissions originating in France are multiplied with the site-dependent impact factor for France to produce the corresponding impact in Europe. The feasibility of this method is questioned. Opponents of site-dependent LCIA argue that this technique requires a lot of extra effort to find the geographical origin (country) of emissions.
The research question of the current study is formulated as: Is spatial differentiation for acidification in LCIA feasible and is it worth the effort? It distinguishes three aspects: effort for extra data collection, gained information from site-dependent LCIA, and experienced difficulties.

The current research applies site-dependent LCIA for acidification to three existing case studies. It performs this additional analysis on LCAs about linoleum, stone wool, and water piping systems. Of each case study the impact category acidification is recalculated using site-dependent LCIA instead of the traditional site-generic LCIA. To be able to determine this impact, the acidifying emissions have to be localized. Localization of emissions requires disaggregation of processes. The current research first identifies the most acidifying processes, using a site-generic approach. Then these processes are disaggregated and the emissions are localized. Finally site-dependent acidification is calculated.
During the implementation of site-dependent LCIA for acidification, only a few difficulties were encountered. Finding the location of the emissions denoted no difficulties. In fact, it hardly took any effort to find where emissions take place, very often the location is already given in the report of the LCA. However, disaggregating processes sometimes did mean difficulties. The reports do not give enough information to fully rebuild the LCA from the basis and all three case studies partly rely on confidential data. This lack of reproducibility of the case studies not only influences our attempt to calculate site-dependent acidification but any other additional analysis as well.
Time required to collect data necessary to locate acidifying emissions determines the extra effort for site-dependent acidification. Times between 39 and 84 hours were measured effort should be related to the gained information. In the linoleum case study 36% of the site-dependent acidification could be calculated using site-dependent LCIA. For stone wool this number equals 93% and for the copper water piping system even 97%. The lower value for the linoleum case study relates to the large amounts of emissions in countries outside of Europe. These emissions could be localized, but no site-dependent factor was available. The applied site-dependent LCIA method condiders those emissions as site-gereric, only for European countries special country-dependent acidification factors exist.